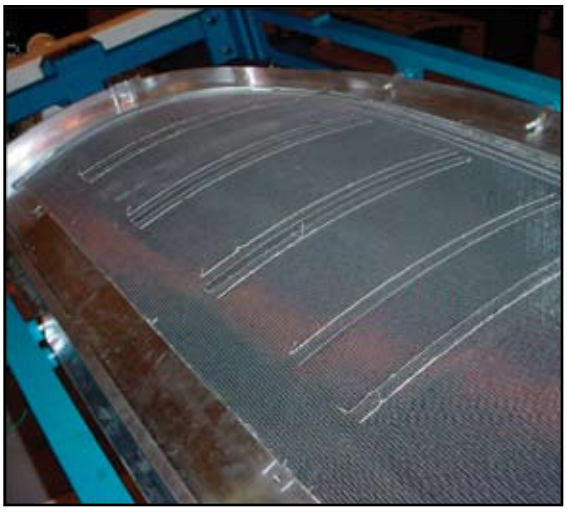
Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

SUCCESS STORY

AFRL IMPROVES DURABILITY FOR C-17 MAIN LANDING GEAR DOORS



Decreasing C-17 main landing gear (MLG) door failure rates should improve aircraft mission capability. AFRL and Boeing engineers developed a manufacturing process to produce a durable composite C-17 MLG door and expect a 40% increase in reliability and no adverse maintainability impact. Phase I of the effort, which affects the two forward inboard doors, should result in an operation and support savings of $532,000 over 25 years and save about 60 mission readiness days per year. Phase II, which affects all eight doors, should generate an operation and support savings of $5.9 million over 25 years and save an additional 30 mission readiness days per year.

Air Force Research Laboratory
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Accomplishment

AFRL worked with Boeing during the Composites Affordability Initiative C-17 technology transition demonstration program to develop and implement a durable composite C-17 MLG door that features stitched preforms, vacuum-assisted resin transfer molding, and an overall improved design.

Background

C-17 MLG door outer skins periodically delaminate and depart from the aircraft during flight. The leading edges of the existing MLG doors have also received foreign object damage (FOD) when the aircraft lands on unimproved runways. These types of damage require extensive man-hours for field-level repair to correct the problems, thereby decreasing mission readiness by over 90 days per year. The necessary repair of the MLG doors was the fourth-leading cause of system downtime and the number one cause of airframe downtime.

To overcome these challenges, the AFRL/Boeing team applied several emerging technologies to an improved design. Boeing changed the baseline composite door from a preimpregnated composite laminate construction to a stitched fiber preform with vacuum-assisted resin transfer molding (VARTM). The stitching of the skin composite preforms to the rib preforms provides the necessary reinforcement to improve delamination resistance over the original baseline skin, which was adhesively bonded to the ribs. The VARTM process provides a lower-cost alternative to the current design. The new process also enables a one-piece door compared to the several pieces represented in the baseline design.

The team redesigned the hinge and actuator fittings of the composite box and eliminated the titanium sheets originally embedded in the composite ribs. They changed the loft of the door to reduce stresses, which caused skin waviness when closed under stress. This redesign, coupled with the stitching, will minimize or eliminate the skin delamination and departure problem. The AFRL/Boeing team made design changes to improve resistance to FOD on the leading edge of the door by incorporating a field-level approach of applying foam and polyurethane tape to the leading edge to absorb impacts.

Boeing and the C-17 program office have decided to implement the new door process and design for the two forward inboard doors, beginning with P160 aircraft. Boeing has tentatively scheduled the remaining door improvements for application to the next block purchase of aircraft.

Materials and Manufacturing
Support to the Warfighter
Air (Sustainment)

Additional Information

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